Size-dependent charge storage of graphene flakes

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Abstract
This paper focuses on the charge storage properties of reduced graphene oxide (rGO) in different flake sizes. Sonication is used to exfoliate rGO into different flake sizes, as confirmed by the spectroscopy and microscopy techniques. The oxygen-related functionalities on rGO samples are quantified by Fourier transform infrared spectroscopy and reveal that higher amount of unreduced oxygen functionalities can be found on rGO with smaller flake size. The charge storage properties of rGO in different flake sizes are studied by cyclic voltammetry, galvanostatic charge discharge and electrochemical impedance spectroscopy. The findings demonstrate that the rGO with smaller flake size possesses higher charge storage capability (238 F g^{-1} at x A g^{-1}), as compared to that of rGO with larger flake size (147 F g-1 at x A g^{-1}). Apart from larger surface area contribution, the unreduced oxygen functionalities in rGO with smaller flake size also plays an important role in contributing pseudocapacitance effect to the rGO. The current findings add substantial understanding of rGO flake size effect towards electrochemical properties..

Keywords: Carbon, Exfoliation, Pseudocapacitance, Supercapacitor, Double Layer Capacitance.